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Particle accelerators to meet gravitational waves

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The observation of the Higgs boson by the LHC (2012), and the direct observation of gravitational waves (GW) from a collapsing binary systems by LIGO (2016) marked the successful end of long-standing efforts, and hopefully the dawn of a new era where both fields, Particle Accelerators (PA) and GW Physics, may benefit from knowledge/technologies developed by the other party. CERN recently hosted a meeting (SRGW2021) where such synergies were discussed, including the possibility of operating storage-rings/colliders as GW sources/detectors. Earth-bound interferometric GW detectors may explore only a tiny subset of the GW spectrum. Spaceborne detectors (LISA) and pulsar-timing observatories will open a window in the LF to ELF range, and different HF to SHF detectors have been proposed (SISSA2019). Observations at these frequencies would bring rich astrophysical/cosmological information. On the other hand, PA advances in superconducting magnets, and extremely high-Q RF cavities, and the (still controversial) possibility that superconductors may act as GW reflectors, suggest to reconsider the feasibility of a GW “Hertz experiment” based on Gertsenshteyn effect; while progress in (big) data analysis, control systems and optical materials from GW experiments may be useful for next gen PA. We review these ideas from a dual perspective, and highlight possible directions for common work.

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Footnotes

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